COMMUNICATION APPARATUS, STORAGE MEDIUM, CAMERA AND PROCESSING METHOD

BACKGROUND OF THE INVENTION

5   Field of the Invention

The present invention relates to a communication apparatus, a storage medium, a camera and a processing method.

Related Background Art

10   One video transmission system has been proposed. In this system, for example, plural video cameras and computers are located inside a building, and these video cameras and the computers are networked through communication lines, thereby realizing video

15   transmission among plural desired points and interactive communication by video and audio.

In such the video transmission system, a user of the computer at one point can remote-control the video camera at the desired point and display the video taken

20   by the remote-controlled video camera on the screen of own computer.

Further, in the video transmission system capable of remote-controlling the video camera, especially, as the number of the video cameras to be remote-controlled

25   increases, it is necessary for the user to easily understand where each video camera is located. Thus, the technique which superimposes a camera symbol

representing the location of each video camera on an image representing a map has been proposed. Further, the technique which represents the direction of the actual video camera by displaying the direction of the

5   camera symbol has been proposed.

In the above system, there is a case where the video camera which is represented by the camera symbol superimposed on the map is operated and controlled by a user at a remote location. In this case, as long as

10   the terminal which utilizes that map does not obtain the state of the video camera concerned, the problem that the state of the camera symbol is not corresponding to the state of the actual video camera is caused.

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SUMMARY OF THE INVENTION

An object of the present invention is to provide a communication apparatus, a storage medium, a camera and a processing method which can unitarily control

20   information concerning video cameras and transmit such the information to all terminals operating the video cameras.

As one preferred example of the present invention, there is provided a communication apparatus which is

25   connected to at least one camera and at least one monitor and manages information concerning a state of the camera, comprising:

reception means for receiving the information concerning the state of the camera; and

transmission means for transmitting the information concerning the state of the camera received by the reception means to the monitor, so as to change display concerning the state of the camera displayed on the monitor,

wherein the transmission means transmits the information in correspondence with the change of the state of the camera.

Another object of the present invention is to provide a communication apparatus, a communication method, a camera and a processing method each of which has a new function.

Other objects and features of the present invention will become apparent from the following detailed description and the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram showing the entire structure of a communication system including a video communication system according to one embodiment of the present invention;

Fig. 2 is a block diagram showing the structure of main software of a video transmitter 20 and a monitor 60 according to one embodiment of the present invention;

Fig. 3 is a view showing a display example of the monitor according to one embodiment of the present invention;

Fig. 4 is a view showing a display example of the monitor according to one embodiment of the present invention;

Fig. 5 is a view showing a display example of a window for displaying video from a video camera, according to one embodiment of the present invention;

Fig. 6 is a view showing the state when display is performed by a drag-and-drop operation, according to one embodiment of the present invention;

Fig. 7 is a view showing a mouse cursor of a video camera used in the drag-and-drop operation according to one embodiment of the present invention;

Fig. 8 is a view showing the state when a display area by the drag-and-drop operation is changed, according to one embodiment of the present invention;

Fig. 9 is a view showing a camera icon representing that taken video is being displayed, according to one embodiment of the present invention;

Fig. 10 is a view showing the state of an operation to stop the display by the drag-and-drop operation according to one embodiment of the present invention;

Fig. 11 is a view showing a display example of the monitor according to one embodiment (fourth embodiment)

of the present invention;

Fig. 12 is a flow chart showing an operation of map management software according to one embodiment (first embodiment) of the present invention;

5   Fig. 13 is a flow chart showing the operation of map management software according to one embodiment (first embodiment) of the present invention;

Fig. 14 is a flow chart showing an operation of video reception software according to one embodiment

10   (first embodiment) of the present invention;

Fig. 15 is a flow chart showing the operation of video reception software according to one embodiment (first embodiment) of the present invention;

Fig. 16 is a flow chart showing the operation of

15   video reception software according to one embodiment (first embodiment) of the present invention;

Fig. 17 is a flow chart showing the operation of video reception software according to one embodiment (first embodiment) of the present invention;

20   Fig. 18 is a flow chart showing the operation of video reception software according to one embodiment (first embodiment) of the present invention;

Fig. 19 is a flow chart showing the operation of video reception software according to one embodiment

25   (first embodiment) of the present invention;

Fig. 20 is a flow chart showing the operation of video reception software according to one embodiment

(first embodiment) of the present invention;

Fig. 21 is a flow chart showing an operation of camera control client software according to one embodiment (first embodiment) of the present invention;

5   Fig. 22 is a flow chart showing the operation of camera control client software according to one embodiment (first embodiment) of the present invention;

Fig. 23 is a flow chart showing an operation of video transmission software according to one embodiment

10   (first embodiment) of the present invention;

Fig. 24 is a flow chart showing an operation of camera control server software according to one embodiment (first embodiment) of the present invention;

Fig. 25 is a flow chart showing the operation of

15   camera control server software according to one embodiment (first embodiment) of the present invention;

Fig. 26 is a flow chart showing an operation of a map management server software according to one embodiment (first embodiment) of the present invention;

20   Fig. 27 is a flow chart showing the operation of the map management server software according to one embodiment (first embodiment) of the present invention;

Fig. 28 is a flow chart showing an operation of map management server software according to one

25   embodiment (second embodiment) of the present invention;

Fig. 29 is a flow chart showing the operation of

map management server software according to one
embodiment (second embodiment) of the present
invention;

Fig. 30 is a flow chart showing an operation of
video reception software according to one embodiment
(third embodiment) of the present invention;

Fig. 31 is a flow chart showing an operation of a
map management server software according to one
embodiment (third embodiment) of the present invention;

Fig. 32 is a flow chart showing the operation of
the map management server software according to one
embodiment (third embodiment) of the present invention;

Fig. 33 is a flow chart showing an operation of
map management software according to one embodiment
(fourth embodiment) of the present invention;

Fig. 34 is a flow chart showing the operation of
map management software according to one embodiment
(fourth embodiment) of the present invention;

Fig. 35 is a flow chart showing an operation of a
map management server software according to one
embodiment (fourth embodiment) of the present
invention;

Fig. 36 is a flow chart showing an operation of
camera control server software according to one
embodiment (fifth embodiment) of the present invention;

. Fig. 37 is a flow chart showing an operation of a
map management server software according to one

embodiment (fifth embodiment) of the present invention; and

Fig. 38 is a flow chart showing the operation of the map management server software according to one embodiment (fifth embodiment) of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[First Embodiment]

Fig. 1 is a block diagram showing the entire structure of a communication system including a video communication system according to one embodiment of the present invention.

In Fig. 1, numeral 10 denotes a video camera which generates video (or an image signal) on the basis of a taken image. Numeral 20 denotes a video transmitter such as a work station (WS), a personal computer (PC) or the like which transmits the image signal from the video camera 10 to a monitor 60 and receives a control signal from the monitor 60 to control the video camera 10. Numeral 60 denotes the monitor such as the WS, the PC or the like which receives the image signal from the video transmitter 20 and transmits the control signal to the video transmitter 20 to control the video camera 10.

The plural video transmitters 20 and the plural monitors 60 can communicate with others through a network 100. Preferably, the video transmitter 20

analog-to-digital (A/D) converts the image signal from
the video camera 10 into digital image data, compresses
the obtained digital image data, and transmits the
compressed data to the monitor 60 through the network

5   100.

Numeral 12 denotes a camera control circuit which
controls panning, tilting, zooming, focusing and
irising operations in accordance with the control
signal (i.e., a control code) from the video

10   transmitter 20. The control signal is input from an
input/output interface (I/O) 32 of the video
transmitter 20 to the camera control circuit 12 on the
basis of, e.g., an RS-232C standard or the like.

If the video camera 10 does not performs the

15   panning, tilting, zooming, focusing and irising
operations, the camera control circuit 12 is not always
necessary. However, it is preferable to control ON/OFF
of the power supply of the video camera 10.
(Video Transmitter 20)

20   Next, the structure of the video transmitter 20
will be explained. Numeral 24 denotes a main memory,
and numeral 26 denotes a storage unit such as a hard
disk or the like. Numeral 28 denotes a mouse which
acts as a pointing device. However, other devices such

25   as a touch panel on a bit map display 35 and the like
may be also used. Numeral 30 denotes a keyboard which
acts as input means. Numeral 25 denotes an external

memory from which a storage medium such as a floppy disk, a CD-ROM or the like is detachable. Numeral 32 denotes the I/O which is connected to the camera control circuit 12 to transmit and receive the control signal of the video camera 10. Numeral 34 denotes a video capture board which captures a video output signal VD of the video camera 10. The video output signal VD may be an analog signal such as a general NTSC (National Television System Committee) signal or a digital signal. If the signal VD is the analog signal, it is necessary for the video capture board 34 to has an A/D conversion function. Numeral 36 denotes a video board which obtains the video captured by the video capture board 34 through a system bus 39 and displays the obtained video at an arbitrary location on the bit map display 35. Numeral 38 denotes a network interface (I/F) which communicates with the monitor 60 through the network 100. The above units are connected to others through the system bus 39, and a CPU 22 controls the video transmitter 20 as a whole and the display of the bit map display 35 in accordance with software stored in the storage medium or the storage unit 26 or software obtained through the network 100.

If the video capture board 34 does not have a data compression function, it is possible to provide software for realizing such the function, whereby the CPU 22 can perform data compression processing.

By such the video transmitter 20 as structured
above, the image data taken by the video camera 10 is
transmitted to the monitor 60 at a remote location
through the network 100, and the video camera 10 is
5   controlled according to the control code received from
the monitor 60.

(Monitor 60)

Next, the structure of the monitor 60 will be
explained. It should be noted that, in the monitor 60,
10   explanation of the devices or the units same as those
in the video transmitter 20 will be omitted. A network
I/F 138 receives the compressed image data from the
video transmitter 20. A CPU 122 decompresses the
received data (i.e., encoded data) by using a video
15   compression decoder 33, and controls a video board 136
on the basis of the decompressed image data to cause a
bit map display 135 to display the image taken by the
video camera 10 and the state of the video camera 10.
Further, the CPU 122 transmits the control code to the
20   video transmitter 20 for controlling the video camera
10, in accordance with data input by the user of the
monitor 60 with use of a keyboard 130 or a mouse 128.

Next, the software of the video transmitter 20 and
the monitor 60 according to the present embodiment will
25   be explained. It should be noted that the software
explained hereinafter is executed by the hardware of
the video transmitter 20 or the monitor 60.

Fig. 2 is a block diagram showing the structure of the main software of the video transmitter 20 and the monitor 60 according to one embodiment of the present invention.

5   First, the software to be executed by the monitor 60 will be explained. Numeral 411 denotes camera control client software which is to remote control the video camera 10 connected to the video transmitter 20. Numeral 412 denotes video reception software which is 10   to decompress the compressed image data transmitted from the video transmitter 20 in the form of packet and display the decompressed image data. Further, the video reception software 412 is to manage image data received from all the video transmitters 20 (i.e., the 15   video cameras 10) connected to the network 100. By the video reception software 412, a camera ID of each video camera, a host computer ID of the video transmitter 20 to which the video camera concerned is connected, the information concerning the camera operation states such 20   as the panning, tilting, zooming, focusing and irising operations, the information concerning whether or not the video camera concerned is controllable, the state information concerning which video camera is currently controlled, and the state information concerning which 25   video camera is currently displayed are stored into the monitor 60. Also the camera control client software 411 and map management software 413 share such the

information, whereby the information is utilized to camera symbol change or the like. Numeral 413 denotes the map management software which uses a GUI (graphical user interface) function. The GUI function is to

5 graphically display the location, the panning state and the tilting state of the video camera 10 and control the operation of the camera 10, by a map, the camera symbol and later-described scope display of Fig. 6. The above software is prestored into the storage unit

10 of the monitor 60.

Next, the software to be executed by the video transmitter 20 will be explained. Numeral 421 denotes camera control server software which is to control the panning, tilting, zooming, focusing and irising

15 operations of the video camera 10 connected to the video transmitter 20 and also capture the image data output from the video camera 10 to the video transmitter 20. Numeral 422 denotes video transmission software which cooperates with the camera control

20 server software 421 and is to transmit the video to the monitor 60 currently controlling the video camera 10. The above software is prestored into the storage unit of the video transmitter 20.

Numeral 431 denotes map management server software

25 which is to unitarily manage the states of all the video cameras of the plural video transmitters 20 and update map information. It should be noted that one

map management server software 431 is executed in one system. Fig. 2 shows that the map management server software 431 is executed in the video transmitter 20. However, the map management server software 431 may be

5 executed in the monitor 60 or another computer connected to the network 100. In this case, the network address of the computer which executes the map management server software 431 is stored in all of the monitors 60 and the video transmitters 20.

10 The map management server software 431 communicates with the video reception software of the monitor 60 and the camera control server software 421 of the video transmitter 20, to update the map information of the system.

15 It is needless to say that, in addition to the above software, software for controlling two-way communication through the network 100, software for controlling the storage units 26 and 126, software for controlling the external memories 25 and 125, and the

20 like are prepared in the system.

(User Interface)

Next, the user interface in the present embodiment, i.e., screen which is displayed on the bit map display 135, will be explained. To simplify the

25 explanation, the user interface will be explained on the premise that one monitor 60 is connected to the video transmitter 20 through the network.

Figs. 3 and 4 are views showing a display example of the monitor according to one embodiment of the present invention. Concretely, Figs. 3 and 4 show one example of the screen displayed on the bit map display

5   135 of the monitor 60. In Fig. 3, numeral 500 denotes a map window in which the map is displayed. In the present embodiment, plural maps 510, 520, 530 and 540 showing layouts of offices, establishments (or stores), warehouses and the like are managed within the map

10 window 500. Since each map is added with a map tab, if the map tab is clicked by the mouse 128, the map added with the clicked tab is displayed up-front (as a map display area 502). At this time, the camera symbols are displayed on the up-front map.

15 Fig. 3 shows the state that the map 520 is selected from among the maps 510 to 540 and displayed on the map display area 502. On the map 510, video camera symbols (or video camera icons) 521, 522, 523 and 524 are displayed as icons. At this time, if the

20 map tab of the map 530 is clicked, the map 530 is displayed as shown in Fig. 4.

In Fig. 4, the map 530 is displayed on the map display area 502, and video camera symbols (or video camera icons) 531 and 532 are displayed on the map 530.

25 Fig. 5 is a view showing a display example of a window for displaying the video (or the image) from the video camera, according to one embodiment of the

present invention. As shown in Fig. 5, in a window

600, the videos taken by the plural video cameras 10

are displayed on plural video display areas 610, 612,

614, 616, 618 and 620 respectively. Numeral 632

5   denotes a trash can icon which is used to delete the

displayed video from the video display area. Numeral

640 denotes a video camera control panel which includes

camera control buttons for the video camera 10. It is

possible by handling these buttons to control the

10   panning, tilting, zooming, focusing and irising

operations of the video camera 10.

In the present embodiment, the six areas are

displayed by way of example. However, the present

invention is not limited to this. Further, these areas

15   may be displayed on the screen which is identical with

the window shown in Fig. 3 or 4.

Next, an outline of software operation of the

video communication system according to the present

embodiment (including the GUI) will be explained with

20   reference to Figs. 6, 7, 8, 9 and 10. In the present

embodiment, if the camera icon on the map 520, 530 or

the like is dragged and dropped (i.e., a drag-and-drop

operation) onto the arbitrary video display area within

the video display window, the motion video transmitted

25   from the video camera corresponding to the dragged and

dropped icon is displayed on the video display area

onto which the camera icon is dropped.

Fig. 6 is the view showing the state when the display is performed by the drag-and-drop operation, according to one embodiment of the present invention. Concretely, Fig. 6 shows the state that video camera icon 523 is dragged and dropped onto the video display area 614. An area 580 represents a video-taking range. If the mouse cursor is located in the range 580 and the range 580 is changed to a dotted-line range, camera zooming is changed, whereby the video-taking range can be changed. Similarly, the panning and tilting operations can be performed by managing the area 580.

Fig. 7 is the view showing the mouse cursor of the video camera used in the drag-and-drop operation according to one embodiment of the present invention. Fig. 8 is the view showing the state when the display area by the drag-and-drop operation is changed, according to one embodiment of the present invention. Fig. 9 is the view showing the camera icon representing that the taken video is being displayed, according to one embodiment of the present invention. Fig. 10 is the view showing the state of the operation to stop the display by the drag-and-drop operation according to one embodiment of the present invention.

In the present embodiment, during the drag-and-drop operation, the shape of the mouse cursor is represented as a camera shown in Fig. 7, whereby the user can confirm that the drag-and-drop operation is

being performed. At this time, on the basis of the location information of the dragged camera, the map management software 413 searches for the ID number of the camera concerned, and notifies the video reception

5   software 412 of the ID of the dragged and dropped camera. On the basis of the notified ID, the video reception software 412 searches for the panning and tilting of the camera, the camera name and the name of the host computer to which the camera is connected, and

10   notifies the camera control client software 411 and the map management software 413 of such information.

The camera control client software 411 communicates with the camera control server software 421 of the video transmitter 20 to which the video

15   camera 10 is connected, through the network 100 in accordance with the notified information. Hereafter, the operation of the video camera 10 connected to the video transmitter 20 is controlled between the camera control client software 411 of the monitor 60 and the

20   camera control server software 421 of the video transmitter 20 concerned. The information concerning the panning operation, the tilting operation and the like of the camera (i.e., the information concerning the camera state) is notified from the camera control

25   client software 411 to the video reception software 412 for a predetermined time or for each issuance of a camera control command.

The map management software 413 updates the map stored in the video board 136, thereby changing the direction of the camera icon according to the direction of the actual video camera 10, drawing a scope 910

5   (Fig. 9) representing that the video (or the image) taken by the video camera 10 concerned is being displayed, and drawing a control pointer 920 (Fig. 9) within the scope 910 to control the panning, tilting and zooming operations of the camera.

10   Further, the information concerning the panning operation, the tilting operation and the like of the camera is notified from the video reception software 412 to the map management software 413 for a predetermined time or for each issuance of the camera

15   control command. Thus, if the panning state, the tilting state, the zooming state and the like of the camera are changed on the camera control panel 640, such the change is reflected on the displaying states of the camera icons 521, 522, 523, 524 and the like.

20   If the camera control server software 421 starts, it communicates with the map management server software 431 through the network 100. Hereafter, if the connection is requested from the camera control client software 411, the camera control server software 421

25   performs predetermined connection processing.

If the video display processing starts and the connection between the camera control server software

421 and the camera control client software 411 is established, the camera control server software 421 notifies the map management server software of such a fact.

5   Hereafter, until the camera control server software 421 is disconnected from the camera control client software 411, the camera control server software 421 notifies the map management server software of "camera state information" every time the state of the

10   video camera is changed or every time a certain time initially set by the camera control server software 421 elapses.

The camera state information includes a time (i.e., a time stamp) when the information is

15   transmitted, attributes of the video camera (i.e., a panning value, a tilting value, a zooming value, etc.), the connection state to the camera control client software 411, a network address of the connected monitor terminal in which the camera control client

20   software 411, and the like.

The map management server software 431 unitarily manages the camera state information transmitted from the entire video camera control server software 421 running within the system.

25   Every time new camera state information is notified from the camera control server software, or every time a certain time initially set elapses, the

map management server software 431 notifies all the
monitors 60 running within the system of the camera
state information of all the connected video
transmitters 20. The network address of the monitor 60

5   is notified to the map management server software 431
when the video reception software 412 starts operation.
Also, the network address may be fixedly set in the map
management server software 431 or may be obtained based
on the camera state information.

10   The camera state information is actually received
by the video reception software 412 and shared by the
camera control client software 411 and the map
management software 413.

The camera state information from the map

15 management server software 431 is notified to the video
reception software 412. Further, the information sent
from the camera control client software 411 of the
monitor 60 as a result of the camera controlling is
notified to the video reception software 412.

20   In order to correctly manage these information
timewise, the camera state information is time-stamp
managed for each video camera in this system. When the
camera state information is notified by the video
reception software 412, the time stamp of each camera

25 is compared with the previous information. If the time
stamp is newer than the previous one, the time stamp is
updated, while if the time stamp is older than the

previous one, the time stamp is discarded.

After the camera state information is updated as above, the video reception software 412 notifies the map management software 413 of such a fact. The map management software 413 changes and updates the camera symbol on the map on the basis of that information. In this case, the change of the display represents changes of photographing range and zooming (i.e., the area 580) shown in Fig. 6.

In Fig. 2, the map management server software 431 is illustrated to be executed in the specific video transmitter 20. However, the map management server software 431 may be executed in any of an arbitrary video transmitter, an arbitrary monitor or another computer connected to the identical network.

The actual image data is transmitted from the video transmitter 20 in accordance with the request from the video reception software 412 of the monitor 60. The video reception software 412 transmits a command to the video transmission software 422 of the video transmitter 20 to which the video camera 10 concerned is connected, through the network 100. This command is to request data transmission of one frame. The video transmission software 422 receives the command, divides the captured latest frame data into packets, and then transmits these packets to the video reception software 412. The video reception software

412 restructures the image frame from the received packets, displays the restructured image frame on the video display area, and again transmits the video transmission request command. By repeating such operations at high speed, the video at the remote location is transmitted and displayed through the network 100. Thus, the video taken by the video camera 10 remotely located is displayed on the bit map display 135 of the monitor 60.

When the videos taken by the plural video cameras 10 are displayed on the screens, the video transmission request command is issued, the captured video is compressed, the frame is divided into the packets, the divided packets are transmitted to the network, the packets are received, the frame is restructured, the compressed data is decompressed, and the decompressed video data is displayed in turn and repeatedly, for each of the video transmission software of the video transmitter 20 to which each camera is connected.

The video taken by the video camera can be shifted by dragging and dropping the displayed video to the desired video display area as shown in Fig. 8. Fig. 8 shows the state that the video taken by the video camera icon 523 displayed on the video display area 614 is shifted to the video display area 612. At this time, the video reception software 412 clears the area 614, and changes internal parameters such that the area

612 (i.e., the drag-and-drop destination) acts as the video display area of the video of the camera 10. Hereafter, the video taken by the video camera 10 concerned is displayed on the drag-and-drop

5   destination. It should be noted that the logical network is not disconnected even by such the operation. Namely, as described later, the once-connected communication network is not disconnected until the video display area displaying the video is dragged and

10   dropped into the trash can icon.

The display of the video taken by the video camera 10 is stopped as shown in Fig. 10. Namely, the video display area on which the video intended to be deleted is being displayed is dragged and dropped into the

15   trash can icon 632 within the video display window. Fig. 10 shows the state after the display of the video of the video camera icon 523 on the video display area 614 is stopped. At this time, the video reception software 412 clears the area 614 to stop issuing the

20   video transmission request command to the software 412 of the video transmitter 20 connected till then. Further, the video reception software 412 notifies the camera control client software 411 and the map management software 413 of the fact that the display

25   was stopped.

The camera control client software 411 receives such the notification, disconnects the network to the

video transmitter 20 concerned, and clears the corresponding video display area. Further, the map management software 413 eliminates the scope display from the icon 523 of the video camera concerned, and

5 updates the map.

Figs. 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37 and 38 are flow charts showing the above-explained software processing.

10 Hereinafter, the respective steps in the flow charts will be explained.

In the flow charts, it should be noted that the step boxed by dotted lines represents the processing by which some communications are performed to another

15 software.

One software is executed in parallel with another software by the function of an operating system (OS). Further, there is a possibility that CPU resources are allocated to another software while one software is

20 being executed.

(Map Management Software: Figs. 12 and 13)

In steps S100 and S102, the map management software 413 shown in Fig. 2 starts operation, and, for example, the map window 500 shown in Fig. 3 is

25 displayed on the bit map display 135.

Steps S110, S112 and S114 represent the processing that the camera symbol (e.g., the video camera icon 521

of Fig. 3) on the window 500 is clicked. If the video
of the video camera represented by this camera symbol
has been displayed on the video window (e.g., the video
display area 610 of Fig. 5), the map management

5   software 413 notifies the video reception software of
focus change (i.e., change of the target to be
controlled). This processing will be explained later
in a step S285.

Steps S120, S122, S124, S125 and S126 represent

10   the processing that the camera symbol (e.g., the video
camera icon 521 of Fig. 3) on the map window is
dragged. While the symbol is being dragged, the shape
of the mouse cursor is changed as shown in Fig. 7.
Then the shape of the mouse cursor is restored if the

15   cursor is dropped.

If the mouse cursor is dropped into the video
window, the map management software 413 notifies the
video reception software of the drop operation. This
processing will be explained later in a step S260.

20   In steps S130 and S132, if the map tab of the map
(e.g., the map 510, 520 or 530 of Fig. 6) is clicked,
the map is changed to the map having the clicked tab,
and the display of the map and the camera symbols is
updated.

25   Steps S140, S150 and S152 represent the processing
which is performed when the focus change (i.e., the
change of the target to be controlled) is notified from

the video reception software by clicking the video on the video window in later-described steps S234, S256 and S267.

Then the map is changed such that the camera symbol corresponding to the focused video is displayed at the center of the map window, and the camera symbol is displayed.

If the camera state is notified from the video reception software in later-described steps S257, S268, S296 and S314, the state display of the camera symbol is updated according to the camera state information.

In steps S160, S162 and S172, if the end menu on the map window displayed by a predetermined operation is clicked, the map management software 413 notifies the video reception software of the end, and the map management software ends.

Steps S180, S182 and S184 represent the processing which is performed when the video camera is controlled by dragging the map symbol (e.g., the control pointer 920 of Fig. 9) with the mouse. The map management software 413 updates the display state of the camera symbol concerned, and notifies the video reception software to control the corresponding video camera.

(Video Reception Software: Figs. 14 to 20)

In a step S200, the video reception software 412 starts operation, and the video window (i.e., the window 600) is displayed on the bit map display 135.

In steps S210, S212 and S214, the video reception software 412 is connected to the predetermined map management server software and starts communication. In this case, an internal flag is on if the video reception software 412 succeeds in connecting with the map management server software, while the internal flag is off if the video reception software 412 fails in.

In steps S220, S222, S224, S226 and S228, if the map management software 413 ends by the processing in the steps S160, S162 and S172, the video reception software 412 stops displaying the video and disconnects the video transmission software. Then the map management software 413 notifies the camera control client software to disconnect the camera control server software, and the video reception software ends.

In steps S230, S232 and S234, if the displayed video (e.g., the video of the display area 614 of Fig. 6) is clicked, the focus (the target to be controlled) is changed to the clicked video, the video reception software 412 notifies the map management software and the camera control client software of focus change (i.e., change of the target to be controlled). Therefore, the map management software performs the processing in the step S140, and the camera control client software performs the processing in the step S420.

Steps S240, S241, S242, S244, S246, S247, S248,

S250, S251, S252, S253, S254, S255, S256, S257, S258 and S259 represent the processing which is performed when the displayed video (e.g., the video of the display area 614 of Fig. 8) is dragged to the display area 612, or when the displayed video (i.e., the video of the display area 614 of Fig. 10) is dragged to the display area 632.

If the video is dropped into the trash can icon, the display of the dropped video is stopped, and the communication with the camera from which the video is transmitted ends (Fig. 15). If the video is dropped into another video display window in which there is no video, the video is shifted to this (i.e., drop destination) window. On the other hand, if there is the video in this window, the communication with the camera which transmits the video to this window ends, and the dropped video is shifted to this (i.e., drop destination) window (Fig. 16).

Steps S260, S261, S262, S263, S264, S265, S266, S267 and S268 represent the processing which is performed when, e.g., the video camera icon 523 is dropped into the video display area 614 as shown in Fig. 6.

If there is the video in the display area of the drop destination, the communication with the video camera which transmits this video ends. Thus, the video which is transmitted from the terminal

corresponding to the video camera icon 523 is displayed in the display area of the drop destination (Fig. 17).

Steps S270 and S272 represent the processing which is performed when the video information is updated in the case where there is the displayed video, after the processing in the steps S260 to S268. In the processing, the video is requested to the video transmission software at predetermined timing. Then the video transmission software performs the processing corresponding to a later-described S530.

Steps S275 and S276 represent the processing which is performed when the video information is transmitted from the video transmission software.

Steps S280 and S282 represent the processing which is performed when the camera symbol on the map management software is mouse-operated (step S180 to S184).

The video reception software notifies the camera control client software to control the video camera which is currently focused (i.e., being the target to be controlled). Thus the camera control client software performs the corresponding processing in a later-described step S430.

Steps S285, S286 and S287 represent the processing which is performed when the camera symbol on the map management software is clicked by the mouse (steps S110 to S114).

The video reception software notifies the camera control client software to change the focus (i.e., the target to be controlled) of the camera corresponding to the camera symbol. Thus the camera control client

5 software performs the processing in a later-described step S420.

Steps S290, S292, S294, S295 and S296 represent the processing which is performed when the camera state is notified from the map management software or the

10 camera control client software.

The camera state information of the entire camera control server software connected is transmitted from the map management server software, at the timing when the new information is transmitted from the camera

15 control server software and the camera state information is updated.

A camera control instruction is transmitted from the camera control client software to the camera control server software every time the video camera is

20 controlled.

The camera state information transmitted to the video reception software is subjected to old and new judgment by using the time stamp for each video camera. The camera state information is updated if it is new,

25 while the camera state information is discarded if it is old.

The updated camera state information is notified

to the map management software and processed in the step S150.

In a step S300, if the connected video transmission software ends by the processing of later-described steps S510 to S514, the video transmission software concerned is disconnected.

In steps S310, S312 and S314, if the camera control server software to which the camera control client software is connected ends by the processing of later-described steps S410 to S412, the video transmission software of the video transmitter 20 to which the camera control server software is connected is disconnected.

In steps S315 and S316, if the connected map management server software ends, the connection flag to the map management server software is turned off, and the map management server software is disconnected.

In a step S320, the connection flag to the map management server software is checked, and reconnection processing is performed if the map management server software is not connected.

This is the processing which is to prevent restart of the entire system when the map management server software is temporarily stopped for some reasons and then restarted.

(Camera Control Client Software: Figs. 21 and 22)

In a step S400, the camera control client software

411 starts operation, and the camera control window (e.g., the video camera control panel 640) is displayed on the bit map display 135.

In steps S410 and S412, if the video reception software ends by the processing in the steps S220 to S228, or if the camera control server software ends by the processing in the steps S620 to S622, the camera control client software disconnects the camera control server software, whereby the camera control client software ends.

In steps S420 and S422, if the focus change is notified by the processing in the steps S234, S267 and S287, the camera control client software checks whether or not the focused video camera is currently controllable. If controllable, for example, the control button on the video camera control panel 640 is made available.

In steps S430, S432 and S435, if the camera control is notified from the video reception software in the step S282, or if the control button is clicked, the camera control client software transmits the control command to the focused camera.

Steps S440 and S442 represent the processing which is performed when the camera control server software returns to the video reception software the notification that the control command from the camera control server software was received in a step S642, by

the processing in the steps S430 to S435. Namely, the camera state is notified to the video reception software. The video reception software processes the returned notification in the step S295.

In steps S450, S452 and S454, the video reception software connects to the camera control client software corresponding to the camera symbol into which the video is dropped, in response to the notification in the step S266. After the connection, the camera control client software notifies the video reception software of the camera state. The video reception software processes this notification in the step S295.

In steps S460, S462 and S464, the camera control client software disconnects the focused camera control server software on the basis of the disconnection notification in the steps S248, S254 and S264. After the disconnection, the camera state is notified to the video reception software. The video reception software processes this notification in the step S295.

(Video Transmission Software: Fig. 23)

Steps S500, S510, S512, S514, S520, S522, S530, S532, S540 and S542 represent the operation of the video transmission software.

Further, these steps represent in detail the processing flows of the video reception client software, the video reception software and the video display software.

(Camera Control Server Software: Figs. 24 and 25)

In a step S600, the camera control server software starts operation.

In steps S610, S612 and S615, the camera control server software connects to the predetermined map management server software and starts the communication. In this case, an internal flag is on if the camera control server software succeeds in connecting with the map management server software, while the internal flag is off if the camera control server software 412 fails in.

Steps S620, S622 and S624 represent the processing which is performed when the end menu is clicked by the predetermined operation.

The camera control server software notifies the map management server software and the camera control client software in connection, of the end. Then the camera control server software ends.

Steps S630 and S632 represent the processing which is performed when the camera control client software performs the connection processing in the step S452.

Steps S640, S642, S644 and S646 represent the processing which is performed when the control instruction is issued from the camera control client software in the step S432. In this case, the vide camera is controlled, and thus obtained camera information is notified to the camera control client

software.

If the connection to the map management server software has been established, the camera state information is notified also to the map management server software.

Steps S650 and S652 represent the processing which is performed when the disconnection processing is performed by the camera control client software in the step S462.

Step S660 and S662 represent the processing which is performed when the map management server software ends in later-described steps S710 to S714.

In this case, the connection ends, and the connection flag is turned off.

In a step S670, the connection flag to the map management server software is checked, and reconnection processing is performed if the map management server software is not connected.

This is the processing which is to prevent restart of the entire system when the map management server software is temporarily stopped for some reasons and then restarted.

(Map Management Server Software: Figs. 26 and 27)

In a step S700, the map management server software starts operation.

In steps S710, S712 and S714, if the displayed end menu is clicked by the predetermined operation, the map

management server software notifies the camera control
server software and the video reception software in
connection, of the end. Then the map management server
software ends.

5   In steps S720, S722, S730 and S732, it waits for
the connection request from the camera control server
software and the video reception software. If the
request is transmitted, the corresponding connection
processing is performed.

10   Steps S750, S752, S760 and S762 represent the
processing which is performed when the disconnection
requests are transmitted from camera control server
software and the video reception software. In this
case, the corresponding disconnection processing is

15   performed.

[Second Embodiment: Figs. 28 and 29]

In the first embodiment, the camera state is
notified to the video reception software at the timing
when the camera state is notified from the camera

20   control server software. However, in the second
embodiment, the camera state is notified to the video
reception software after a predetermined time elapses.

Figs. 28 and 29 shows the flow charts showing the
operation of the map management server software. It

25   should be noted that the operations of other software
in the second embodiment are substantially the same as
those in the first embodiment.

The changed parts (i.e., the parts different from those of the first embodiment) in the flow charts are as follows.

In steps S740 and S742, if the camera state is notified from the camera control server software, the camera information of the video camera concerned is updated.

In steps S770 and S772, if the previously set (predetermined) time elapses, the camera information of all the video cameras is notified to the video reception software of the plural monitors in connection.

[Third Embodiment: Figs. 30, 31 and 32]

In the first embodiment, the map management server software notifies the camera state to the video reception software. However, in the third embodiment, the video reception software inquires of the map management server software as to the camera state every time a predetermined time elapses.

Fig. 30 shows the operation flow of the third embodiment which is different from that of the first embodiment.

The changed parts (i.e., the parts different from those of the first embodiment) in the flow charts are as follows. It should be noted that the operations of other software in the third embodiment are substantially the same as those in the first

embodiment.

In steps S290 and S291, instead of the processing that the camera state notification is checked from the map management server software, the map state request is notified to the map management server software every time the predetermined time elapses, and the video reception software waits until the camera state is notified. It should be noted that the processing after the camera state is notified is the same as that in the first embodiment.

Figs. 31 and 32 show the operation flow of the map management server software.

The changed parts (i.e., the parts different from those of the first embodiment) in the flow charts are as follows. It should be noted that the operations of other software in the third embodiment are substantially the same as those in the first embodiment.

In steps S740 and S742, if the camera state is notified from the camera control server software, the camera information of the video camera concerned is updated. At this timing, the camera state is not notified to the video reception software in connection.

In steps S770 and S772, if the camera state request is notified from the video reception software, the camera state is notified to the video reception software concerned. Unlike the first embodiment, such

the camera state is not notified simultaneously to all
the video reception terminals connected to the map
management server software.

[Fourth Embodiment: Figs. 33, 34 and 35]

5   In the first to third embodiments, the file which
represents the structure of the map itself called "map
file" in which the bit map images such as the map and
the camera symbols, the locations of the camera symbols
on the map, the kinds of video cameras and the like

10   have been written is held in each map management
software.

However, in the fourth embodiment, the map
management server software unitarily manages the map
file.

15   By the fourth embodiment, in addition to the
camera state when the system is operating, the bit map
images of the map and the camera symbols, the locations
of the camera symbols on the map are unitarily managed.
Thus, the user can use the identical map at all the

20   monitors accessing the identical map management server
software.

In the present embodiment, a communication
capability to the map management server software is
added to the map management software in the first

25   embodiment, whereby the map management software of the
monitor 60 can obtain the bit map images of the map and
the camera symbols from the map management server

software of the video monitor 20.

The changed parts (i.e., the parts different from those of the first embodiment) in the flow charts are shown in Figs. 34 and 35. It should be noted that the operations of other software in the fourth embodiment are substantially the same as those in the first embodiment on the premise that "camera information" (i.e., the camera information of all the video cameras) is replaced with "map file" (i.e., the bit map images such as the map and the camera symbols, the locations of the camera symbols on the map, the kinds of video cameras, and the camera information of all the video cameras).

However, if the bit map file is frequently copied, the load is given to the processing. Therefore, the bit map file may be copied only at the timing when the map management software starts and when an update button 590 of Fig. 11 is clicked by the mouse.

In a step S102, if the map management software starts, it connects to the map management server software and requests the map file (i.e., the bit map images such as the map and the camera symbols, the locations of the camera symbols on the map, the kinds of video cameras, and the camera information of all the video cameras). Then the map management software receives the data, and displays the map and the camera symbols on the window in accordance with the received

data.

In steps S190 and S192, when the update button is clicked, the map management software connects to the map management server software, requests the map file (i.e., the bit map images such as the map and the camera symbols, the locations of the camera symbols on the map, the kinds of video cameras, and the camera information of all the video cameras), and receives the data. Then the map management software displays the map and the camera symbols on the window in accordance with the received data.

By the above processing, in the case where the bit map images such as the map and the camera symbols, and the locations of the camera symbols on the map are changed while the map management software is running, it is possible to obtain the data after the change without restarting the system.

In steps S770 and 772, if the map file is requested from the map management software, the map file is transmitted, and the map management software is disconnected.

By the above procedure, the map file can be always maintained and updated unitarily, whereby the user can use the identical map at all the monitors accessing the identical map management server software. Also, the new camera information can be always displayed.

In this case, although the present embodiment has

been explained in the form of expansion of the system already explained in the first embodiment, the present embodiment is not limited to this.

For example, the map management server software may be replaced with Web server software, the map management software may be replaced with Web browser software, and the video display client software or the camera control client software may be replaced with plug-in software or helper application.

In this case, the map file may be obtained from the Web server software every time an update button on Netscape Navigator or Internet Explorer is clicked, as shown in the third embodiment.

Further, by using a so-called server push method which transmits the data from the Web server software to the Web browser software without request from the Web browser, the map file transmitted as in the first and second embodiments may be received.

[Fifth Embodiment: Figs. 36, 37 and 38]

In the fourth embodiment, the bit map images such as the map and the camera symbols and the locations of the camera symbols on the map are unitarily managed by the map management server software.

When the actual camera disposing location and the initial direction of a pan head are changed, it is necessary to update the map file according to the change. However, the video camera is not always

disposed at the location in the vicinity of the map

management server software, the user must move to

location of the map management server software and

change the map file after the actual camera disposing

5   location is changed. It seriously costs to do so in

time and operation.

The fifth embodiment is directed to one example to

solve such a problem. In the present embodiment,

coordinates of the camera symbol on the map

10   corresponding to the video camera concerned and an

input unit for inputting the initial direction of the

pan head are provided for the camera control server

software. Further, the a communication unit for

communicating the input information to the camera

15   management server software is also provided.

The changed parts (i.e., the parts different from

those of the first embodiment) in the flow charts are

shown in Figs. 36 to 38.

In a step S602, if the camera control server

20   software starts, the coordinates of the camera symbol

on the map connected to the video transmitter in which

the camera control server software concerned is running

and the initial direction of the pan head are read from

the predetermined initial setting file.

25   In a step S612, if the connection to the map

management server software ends, the coordinates of the

video camera on the map and the initial direction of

the pan head are notified to the map management server software.

The map management server software receives the data and updates the map file.

5   In a step S724, if the connection to the camera control server software ends, the map file is updated according to the notified coordinates of the video camera on the map and the notified initial direction of the pan head.

10   A step S754 represents the processing which is performed when the camera control server software ends and the disconnection is notified.

The disconnection processing is performed, the map file is updated, and the fact that the camera control 15   server software does not run is notified to the video reception software.

The video reception software notifies the map management software of such the information, and the map management software updates the map symbol.

20   [Other Embodiments]

The present invention is applicable to a system composed of plural equipments (e.g., a host computer, an interface equipment, a reader, a printer and the like) or to an apparatus including a single equipment 25   (e.g., a copying machine, a facsimile machine or the like).

It is needless to say that the object of the

present invention can be achieved in a case where a storage medium storing the program codes of a software for realizing the functions of the above-described embodiments is supplied to a system or an apparatus and then a computer (or CPU or MPU) in the system or the apparatus reads and executes the program codes stored in the memory medium.

In this case the program codes themselves read from the storage medium realize the functions of the embodiments, and the storage medium storing such the program codes constitute the present invention.

The storage medium storing the program codes can be, for example, a floppy disk, a hard disk, an optical disk, a magnetooptical disk, a CD-ROM, a CD-R, a magnetic tape, a non-volatile memory card, a ROM, or the like.

It is needless to say that the present invention also includes not only the case where the functions of the embodiments are realized by the execution of the program codes read by the computer, but also a case where an OS (operating system) or the like functioning on the computer executes all the process or a part thereof according to the instructions of the program codes, thereby realizing the functions of the embodiments.

Further, it is needless to say that the present invention further includes a case where the program

codes read from the storage medium are once stored in a memory provided in a function expansion board inserted in the computer or a function expansion unit connected to the computer, and a CPU or the like provided in the function expansion board or the function expansion unit executes all the process or a part thereof according to the instructions of such program codes, thereby realizing the functions of the embodiments.

According to the above-explained embodiments, the information of the video camera and the map information in the vicinity of the location at which the video camera is disposed can be unitarily managed, and the managed information can be notified to all the terminals operating the video cameras timewise as accurate as possible.

Further, in the communication apparatus which is connected to at least one camera and at least one monitor and manages the information concerning the state of the camera, there are provided the reception means for receiving the information concerning the state of the camera, and the transmission means for transmitting the information concerning the state of the camera received by the reception means to the monitor, so as to change display concerning the state of the camera displayed on the monitor, whereby the state of the camera can be recognized at the monitor.

Further, when the image data taken by the camera

is received by the monitor, the states of the camera (i.e., the disposing location, the photographing range, the information of zooming) can be simultaneously grasped.

Further, if the information concerning the state of the camera is transmitted according to the change of the state of the camera, the state of the camera can be quickly grasped. Further, since such the transmission is performed according to the request from the monitor, the state of the camera can be grasped according to necessity, without redundant transmission.

Further, in the communication apparatus which is connected to at least one camera and at least one monitor and manages the information concerning the state of the camera, there are provided the reception means for receiving the information concerning the state of the camera, the processing means for changing the display image concerning the state of the camera displayed on the monitor, in accordance with the received information concerning the state of the camera, and the transmission means for transmitting the display image concerning the state of the camera processed by the processing means, to the monitor, whereby the display image concerning the state of the camera can be obtained at the monitor. Therefore, if the information concerning the state of the camera is received at the monitor and the display image is formed

according to the received result, it is possible to prevent that the size of the monitor increases.

As a result, for example, as the number of the monitors increases, it is possible to reduce the size of the entire apparatus in the system including the cameras, the communication units and the monitors.

Further, since the transmission is performed according to the request from the monitor, it is possible to limit the number of transmission of the data (i.e., the image) of which data quantity is large.

Further, the transmission means is provided which transmits the information concerning the state of the camera to the monitor such that the information concerning the state of the camera is reflected on the map screen for controlling the camera displayed on the monitor. Thus, even if the camera is distant from the monitor, the state of the camera can be quickly reflected on the monitor. For this reason, for example, if the plural cameras are disposed, the load to the operator can be reduced as compared with the case where the operator sets the state information of the plural cameras after he sets the plural cameras. Thus, it is possible to prevent the error that the state of the camera does not coincide with that of the monitor.